

Comparative chemical analyses of seven endemic Greek *Citrus* hybrids

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In the framework of our studies on Greek *Citrus* hybrids, we report here the chemical analyses of the oils from cold pressed peels of one grapefruit [*Citrus paradisi* Cv. Star Ruby x *Citrus aurantium*], four oranges [*Citrus sinensis* cv. Newhall x Citrumelo C. *sinensis* Cv. Newhall x trifoliata, C. *sinensis* Cv. Valencia Porou x citrumelo, C. *sinensis* Cv. Valencia Porou x trifoliata], one pomelo [C. *grandis* Cv. Cuban shaddock x trifoliata] and one mandarin [*Citrus reticulata* Cv. Tangelo Minneola x trifoliata]. All volatiles have been analyzed through GCMS and forty five constituents were identified: Terpenes (94%-99%), among which monoterpenes (88-98%) with limonene as the most abundant (80-95%). It is noteworthy that the detection of the sesquiterpene nootkatone (3.76%) in the essential oil of *Citrus paradise*, which is well known to inhibit acetylcholinesterase, which is the most expensive and valuable component of all Citrus. The essential oils of all six among studied *Citrus* leaves showed a different chemical profile in comparison with their peels content, as sabinene is considered (0.6%-78.5%) as the main component, which is in accordance with literature, while only in mandarin (*Citrus reticulata*) was absent. Moreover, alkanes are identified in high percentages in all *Citrus* samples. Furthermore, six polymethoxyflavones were isolated and structurally determined by NMR spectroscopy from the peels of C. *sinensis* Cv. Valencia Porou x citrumelo and *Citrus reticulata* respectively. Their structures were identified as: 3',4',5,6,7-pentamethoxyflavone (sinensetin), 3',4',5,6,7,8-hexamethoxyflavone (nobiletin), 3',4',3,5,6,7-hexamethoxyflavone, 4',5,6,7-tetramethoxyflavone, 3,5,6,7,8,3',4'-heptamethoxyflavone (3-methoxy-nobiletin)

and 4',5,6,7,8-pentamethoxyflavone (tangeretin), together with the fatty acid linoleic acid. All the above isolated polymethoxyflavones are among appreciated chemotaxonomic markers in *Citrus* genus showing also strong bioactivities (antioxidant, anti-inflammatory, antibacterial, cytotoxic).

Recent Publications

1. Miyazawa M, Okuno Y, Fukuyama M, Nakamura S and Kosaka H (1999) Antimutagenic activity of polymethoxyflavonoids from *Citrus aurantium*. Journal of Agricultural and Food Chemistry 47(12):5239–5244.
2. Furusawa M, Hashimo T, Noma Y and Asakawa Y (2005) Highly efficient production of nootkatone, the grapefruit aroma from valencene, by biotransformation. Chemical and Pharmaceutical Bulletin 53(11):1513–1514.
3. Gossiau A, Chen K Y, Ho C T and Li S (2014) Anti-Inflammatory effects of characterized orange peel extracts enriched with bioactive polymethoxyflavones. Food Science and Human Wellness 3(1):26–35.
4. Borah N, Gunawardana S, Torres H, Mc Donnell S and Van Slambrouck S (2017) 5,6,7,3',4',5'-Hexamethoxyflavone inhibits growth of triple-negative breast cancer cells via suppression of MAPK and Akt signaling pathways and arresting cell cycle. International Journal of Oncology 51(6):1685–1693.

5. Lai H C, Wu M J, Chen P Y, Sheu T T, Chiu S P, Lin M H, Ho C T and Yen J H (2011) **Neurotrophic effect of *Citrus* 5-Hydroxy-3,6,7,8,3',4'-hexamethoxyflavone: promotion of neurite outgrowth via cAMP/PKA/CREB pathway in PC12 Cells.** PLoS One 6(11):e28280.

Biography

Eleni Anastasopoulou has graduated from the Faculty of Agriculture, at the Department of Food Science and Technology, Aristotle University of

Thessaloniki (GR). Throughout her studies, she appreciated the value of natural products, therefore during her research thesis; she optimized a green extraction method for the recovery of polyphenols from olive leaf using cyclodextrins and glycerin as co-solvents. Furthermore, she participated in the creation of an innovative yoghurt product, on the Greek competition Ecotrophelia 2016. Finally, she continued her Postgraduate studies in the Div. of Pharmacognosy and Chemistry of Natural Products, Dept. of Pharmacy at National and Kapodistrian University of Athens. In the framework of her dissertation on essential oils, she had the opportunity to learn the analytical methods on the isolation, development, production and control of bioactive natural products.